Climate: Focus is on carbon dioxide

Global Warming Special Report: Climate models predict big picture; the West must do its own research

By Greg Lavine
The Salt Lake Tribune

Deep in Red Butte Canyon, Andrew Moyes surveys PVC pipes buried in the dusty ground of a meadow.

University of Utah doctoral student Andrew Moyes checks his carbon dioxide (CO2) measuring devices located in the Parleys Fork area in Red Butte Canyon. Moyes is in his second field season of monitoring the CO2 gas well devices every week to determine how carbon dioxide released from the ground affects the planet's carbon cycle and impacts global warming. (Leah Hogsten/The Salt Lake Tribune)

The University of Utah graduate student begins to tinker with a small green device on metal legs and a white cylindrical attachment in preparation of measuring tiny amounts of carbon dioxide coming from the soil.

This patch of Utah dirt is barely a blip in the planet's massive carbon production and storage cycle, in which CO2 plays a major role. But these types of small-scale studies are part of an expanding body of evidence scientists are gathering as they try to understand the intricate dynamics of global warming.

Today's global climate models reveal a warming planet, a process most scientists believe is already under way.

These complex global climate models simulate how Earth's climate as a whole may look in 2100. Because these computer-driven models are designed for the big picture, they falter when trying to focus in on smaller places, such as Utah.

"Using those models, it's always difficult to make projections for individual small regions," said Thomas Reichler, a U. meteorologist.

Warming globally: According to the Intergovernmental Panel on Climate Change's 2001 report, the average temperature of the planet could rise between 2 and 10 degrees by 2100. Some areas would see greater increases.

Most scientists believe rising temperatures are linked to increasing CO2 levels, some of which is coming from cars and coal-fired power plants.

As CO2 levels grow in the atmosphere, these gas particles act to trap heat. With less heat escaping into space, the so-called greenhouse effect, temperatures rise.

If this trend continues, as most scientists expect it will, global warming may lead to rising seas that could wash away places such as New Orleans and the

Netherlands. Millions would be forced to higher ground. Parts of China and Africa may see increasing desertification, which would reduce farmland.

Some critics suggest this warming could be part of a natural, centuries-long cycle. But scientists are alarmed by the fact that CO2 levels are rising to unprecedented levels in lock step with the steady rise in average temperatures.

Other skeptics question how humans could possibly alter a planet that has survived billions of years, but most scientists agree people are contributing to rising CO2 levels.

For scientists, the remaining carbon questions include determining how to put a figure on how much people are contributing to this growing problem. Even without the final tally about human impact, today's global climate models point to a warmer future.

Warming locally: When eyeing the future of Utah and the Rocky Mountains, higher temperatures are among the few areas where the models agree. Researchers have watched Utah's average temperature rise over the past century. The warming trend is expected to continue.

Some climate models suggest the Rockies region could see an average temperature increase of up to 8 degrees by 2100.

The key question to Utah desert dwellers is water availability. And the answers are unclear.

A 2003 regional climate change report poses a scenario that Utah could be in for a water-logged future. One scenario points to the potential of a 184 percent increase in average precipitation, based on climate models from the late 1990s.

"[It] is not clear that the western U.S. engineering infrastructure of dams, reservoirs and aqueducts would be able to control the run off and severe flooding problems could develop," the report authors wrote of the wetter scenario. "The Wasatch Front of Utah would be at distinct risk from rising levels of the Great Salt Lake."

Even with wetter conditions, the window for snow could
be shorter, meaning smaller snowpacks.

More recent climate models, when looking at western North America, suggest the possibility of small increases in precipitation, though where Utah falls in that scenario is unknown.

Why is it so hard to get a handle on Utah's water forecast? Sheer computing power is one culprit.

The complex computer programs that drive climate models take months to run simulations. To model the whole planet, researchers carve up the globe into pieces. In some cases, the whole western United States may be one puzzle piece, treating climates in Provo and Portland, Ore., as being identical.

Until computers become more powerful, projections on Utah's future climate will remain in doubt.

Working it out: Work being done at the University of Utah could help create better information for climate models.

The questions that most intrigue Moyes, and others working under U. biologist Dave Bowling, are less about global warming and more about basic biology.

Before the first automobiles rumbled to life and the earliest coal-fueled power plants fired up, nature produced carbon dioxide. The whole planet - soils, trees, oceans - inhales and exhales this greenhouse gas.

Scientists have written volumes on the carbon cycle, but there remain problems to be solved.

Moyes looks into the amounts of CO2 that move through the soil. Some measuring stations in Red Butte Canyon are near grasses, while others sit beneath towering Box Elder trees.

Carefully placing the white cylinder over the open end of the soil-filled PVC pipe, Moyes began to record CO2 levels rising from the ground. Plants, through their roots, and microbes, by decomposing organic matter, emit CO2 through the soil into the air.

"I want to sort out what is coming from plants and what is coming from . . . decomposers,"
Moyes said as he downloaded readings from a field station.

On this dry afternoon, there was little CO2 to measure from the soil.

Parched soil prevents microbes from devouring organic matter to give off CO2.
Dying and dormant vegetation mean roots are not releasing the greenhouse gas either.

When this data is combined with results from more active times of CO2 release, a picture will emerge.

Bowling said his group's work could benefit the study of climate change. Improving how ecologists understand the natural side of the carbon cycle will help determine how much humans are tipping the scales.

"We can't understand how [humans] perturb the system until we understand the system itself," Bowling explained.

glavine@sltrib.com

This story was based on interviews with researchers from: National Center for Atmospheric Research, Boulder, Colo., Linda Mearns and David Yates; the Scripps Institute of Oceanography, La Jolla, Calif., Daniel Cayan; the University of Utah, Dave Bowling, assistant professor, biology, Lis Cohen, graduate student, meteorology, Phyllis Coley, professor, biology, Thomas Kursar, associate professor, biology, Andrew Moyes, graduate student, biology, Frank Reichler, assistant professor, meteorology, and Jim Steenburgh, associate professor, meteorology; and Utah State University, Robert Gillies, associate professor, Utah Climate Center, Fred Wagner, professor emeritus, forest, range and wildlife sciences, and James Powell, professor, mathematics. Information from the following reports were used: the Intergovernmental Panel on Climate Change report, 2001, and Preparing for a Changing Climate, the Potential Consequences of Climate Variability and Change, Rocky Mountain/Great Basin, 2003.